

## Power MOSFET, 38 A



SOT-227

### FEATURES

- Fully isolated package
- Easy to use and parallel
- Low on-resistance
- Dynamic dV/dt rating
- Fully avalanche rated
- Simple drive requirements
- Low drain to case capacitance
- Low internal inductance
- UL approved file E78996 
- Designed for industrial level
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

RoHS  
COMPLIANT

PRODUCT SUMMARY	
$V_{DSS}$	500 V
$R_{DS(on)}$	0.13 $\Omega$
$I_D$	38 A
Type	Modules - MOSFET
Package	SOT-227

### DESCRIPTION

Third Generation Power MOSFETs from Vishay Semiconductors provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The SOT-227 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 500 W. The low thermal resistance of the SOT-227 contribute to its wide acceptance throughout the industry.

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Continuous drain current at $V_{GS}$ 10 V	$I_D$	$T_C = 25^\circ C$	38	A
Pulsed drain current		$T_C = 100^\circ C$	24	
Pulsed drain current	$I_{DM}$ <sup>(1)</sup>		150	
Power dissipation	$P_D$	$T_C = 25^\circ C$	500	W
Linear derating factor			4.0	W/ $^\circ C$
Gate to source voltage	$V_{GS}$		$\pm 20$	V
Single pulse avalanche energy	$E_{AS}$ <sup>(2)</sup>		580	mJ
Avalanche current	$I_{AR}$ <sup>(1)</sup>		38	A
Repetitive avalanche energy	$E_{AR}$ <sup>(1)</sup>		50	mJ
Peak diode recovery dV/dt	dV/dt <sup>(3)</sup>		10	V/ns
Operating junction and storage temperature range	$T_J, T_{Stg}$		- 55 to + 150	$^\circ C$
Insulation withstand voltage (AC-RMS)	$V_{ISO}$		2.5	kV
Mounting torque		M4 screw	1.3	Nm

#### Notes

(1) Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)

(2) Starting  $T_J = 25^\circ C$ ,  $L = 0.80$  mH,  $R_g = 25 \Omega$ ,  $I_{AS} = 38$  A (see fig. 12)

(3)  $I_{SD} \leq 38$  A,  $dI/dt \leq 410$  A/ $\mu$ s,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 150^\circ C$

## THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Junction and storage temperature range	$T_J, T_{Stg}$		- 55	-	150	°C
Junction to case	$R_{thJC}$		-	-	0.25	°C/W
Case to heatsink	$R_{thCS}$	Flat, greased surface	-	0.05	-	
Weight			-	30	-	g
Mounting torque			-	-	1.3	Nm
Case style		SOT-227				

ELECTRICAL CHARACTERISTICS ( $T_J = 25$  °C unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Drain to source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ V, $I_D = 1.0$ mA	500	-	-	V
Breakdown voltage temperature coefficient	$\Delta V_{(BR)DSS}/\Delta T_J$	Reference to 25 °C, $I_D = 1$ mA	-	0.66	-	V/°C
Static drain to source on-resistance	$R_{DS(on)}$ <sup>(1)</sup>	$V_{GS} = 10$ V, $I_D = 23$ A	-	-	0.13	Ω
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250$ μA	2.0	-	4.0	V
Forward transconductance	$g_{fs}$	$V_{DS} = 25$ V, $I_D = 23$ A	22	-	-	S
Drain to source leakage current	$I_{DSS}$	$V_{DS} = 500$ V, $V_{GS} = 0$ V	-	-	50	μA
		$V_{DS} = 400$ V, $V_{GS} = 0$ V, $T_J = 125$ °C	-	-	500	
Gate to source forward leakage	$I_{GSS}$	$V_{GS} = 20$ V	-	-	200	nA
Gate to source reverse leakage		$V_{GS} = -20$ V	-	-	-200	
Total gate charge	$Q_g$	$I_D = 38$ A	-	280	420	nC
Gate to source charge	$Q_{gs}$	$V_{DS} = 400$ V	-	37	55	
Gate to drain ("Miller") charge	$Q_{gd}$	$V_{GS} = 10$ V; see fig. 6 and 13 <sup>(1)</sup>	-	150	220	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 250$ V	-	42	-	ns
Rise time	$t_r$	$I_D = 38$ A	-	340	-	
Turn-off delay time	$t_{d(off)}$	$R_g = 10$ Ω (ιντερναλ)	-	200	-	
Fall time	$t_f$	$R_D = 8$ Ω, see fig. 10 <sup>(1)</sup>	-	330	-	
Internal source inductance	$L_s$	Between lead, and center of die contact	-	5.0	-	nH
Input capacitance	$C_{iss}$	$V_{GS} = 0$ V	-	6900	-	pF
Output capacitance	$C_{oss}$	$V_{DS} = 25$ V	-	1600	-	
Reverse transfer capacitance	$C_{rss}$	$f = 1.0$ MHz, see fig. 5	-	580	-	

## Note

<sup>(1)</sup> Pulse width ≤ 300 μs, duty cycle ≤ 2 %

## SOURCE-DRAIN RATINGS AND CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Continuous source current (body diode)	$I_s$	MOSFET symbol showing the integral reverse p-n junction diode.	-	-	38	A
Pulsed source current (body diode)	$I_{SM}$ <sup>(1)</sup>		-	-	150	
Diode forward voltage	$V_{SD}$ <sup>(2)</sup>	$T_J = 25$ °C, $I_s = 38$ A, $V_{GS} = 0$ V	-	-	1.3	V
Reverse recovery time	$t_{rr}$	$T_J = 25$ °C, $I_F = 38$ A; $dl/dt = 100$ A/μs <sup>(2)</sup>	-	830	1300	ns
Reverse recovery charge	$Q_{rr}$		-	15	22	μC
Forward turn-on time	$t_{on}$	Intrinsic turn-on time is negligible (turn-on is dominated by $L_s + L_D$ )				

## Notes

<sup>(1)</sup> Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)

<sup>(2)</sup> Pulse width ≤ 300 μs, duty cycle ≤ 2 %

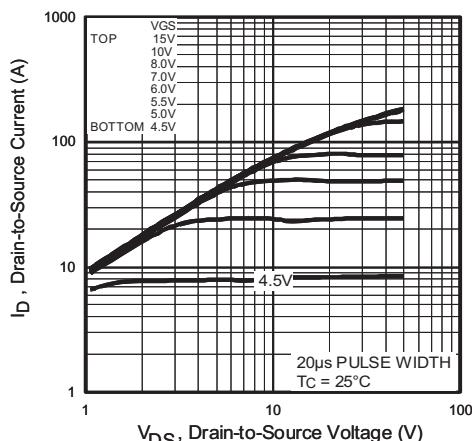


Fig. 1 - Typical Output Characteristics

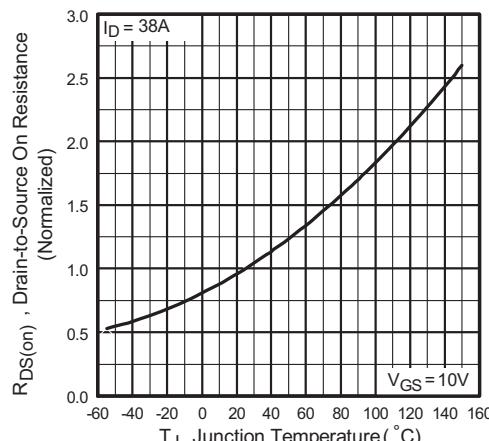


Fig. 4 - Normalized On-Resistance vs. Temperature

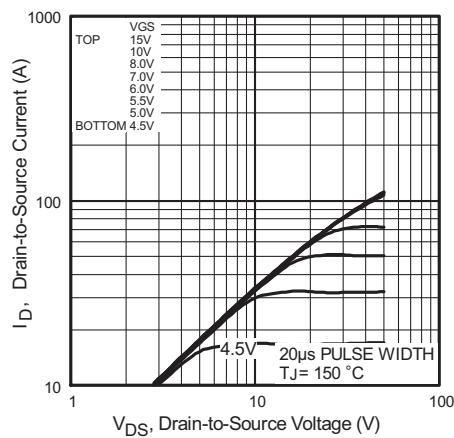


Fig. 2 - Typical Output Characteristics

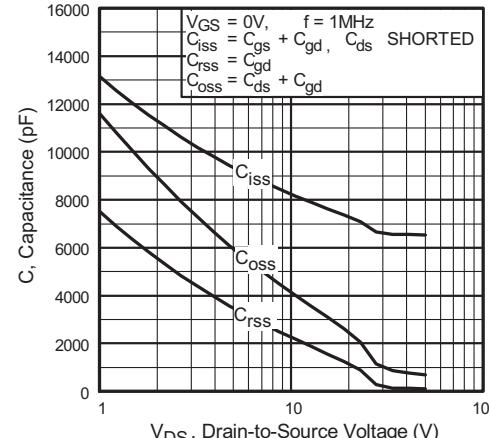


Fig. 5 - Typical Capacitance vs.  
Drain to Source Voltage

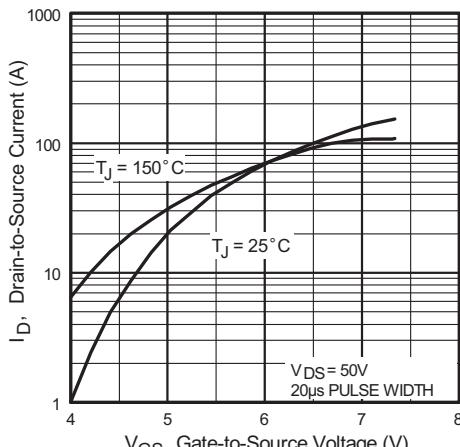


Fig. 3 - Typical Transfer Characteristics

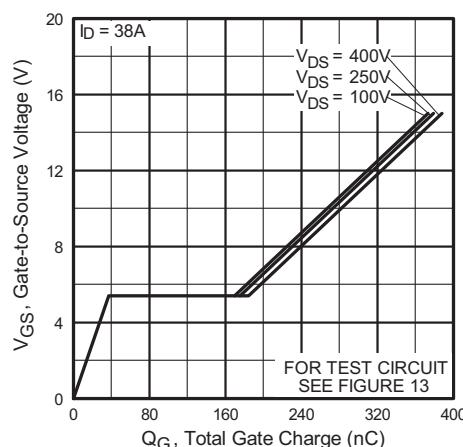
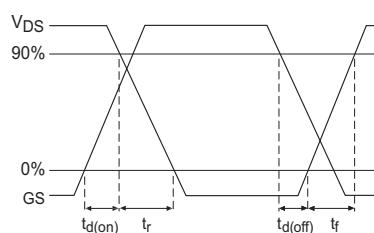
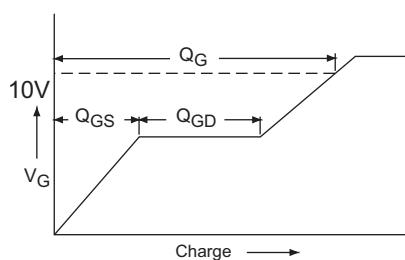
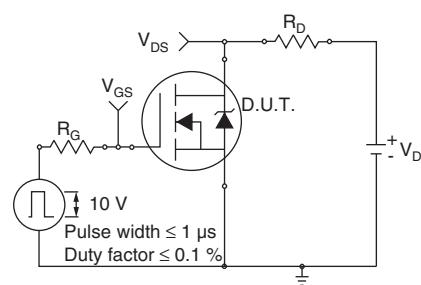
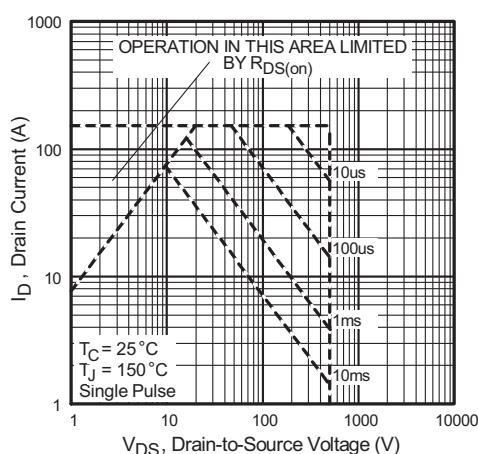
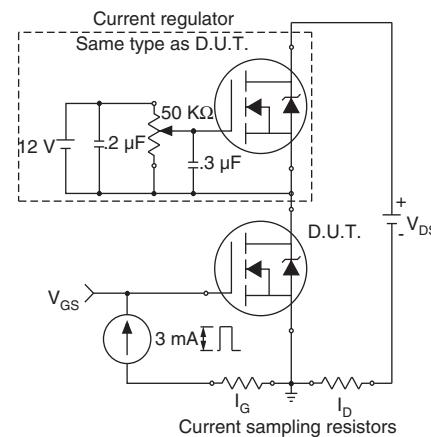
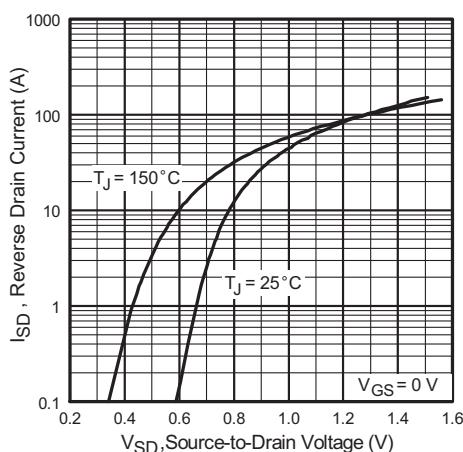


Fig. 6 - Typical Gate Charge vs.  
Gate to Source Voltage



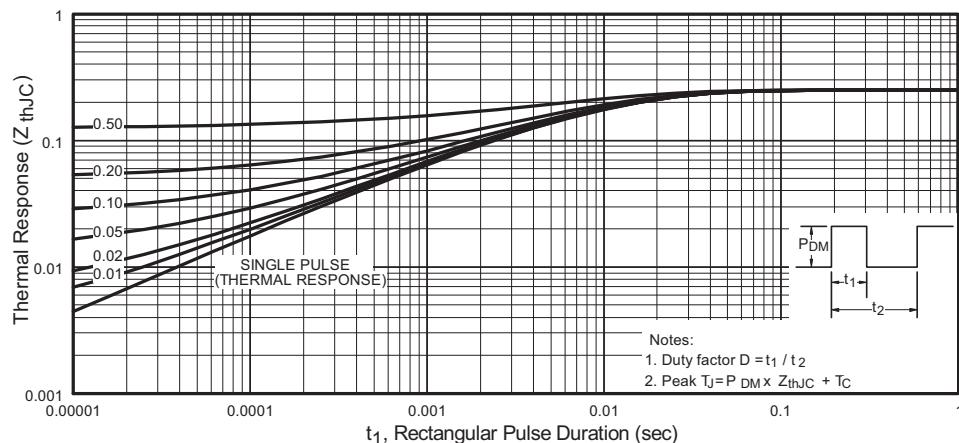


Fig. 13 - Maximum Effective Transient Thermal Impedance, Junction to Case

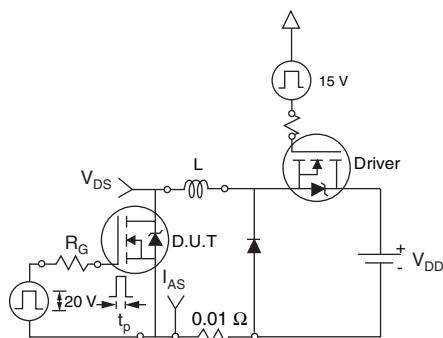


Fig. 14 - Unclamped Inductive Test Circuit

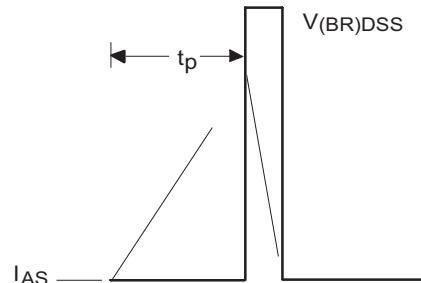


Fig. 15 - Unclamped Inductive Waveforms

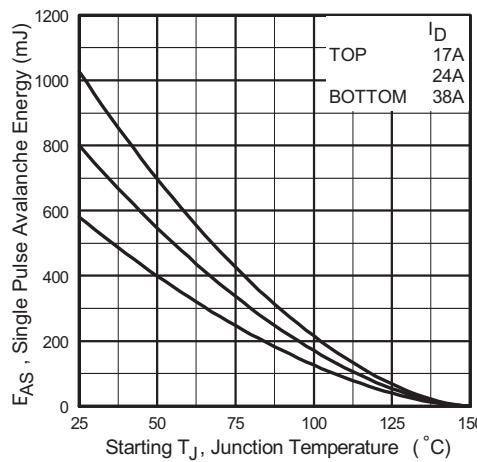


Fig. 16 - Maximum Avalanche Energy vs. Drain Current

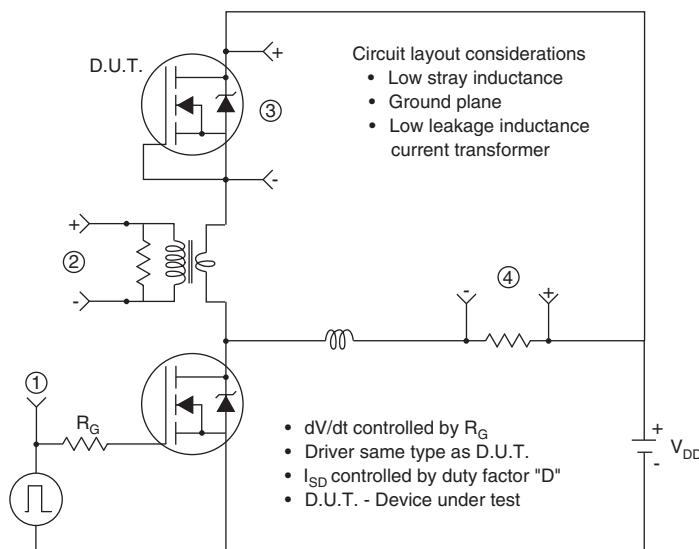
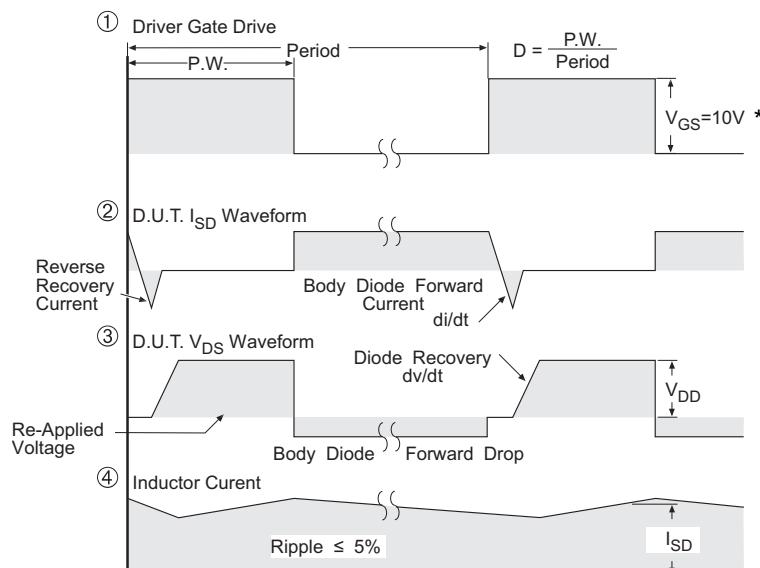
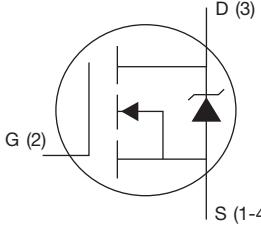
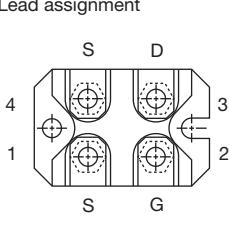
Fig. 17 - Peak Diode Recovery  $dV/dt$  Test Circuit\*  $V_{GS} = 5V$  for Logic Level Devices

Fig. 18 - For N-Channel Power MOSFETs

## ORDERING INFORMATION TABLE

Device code	VS-	F	A	38	S	A	50	LC	P
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

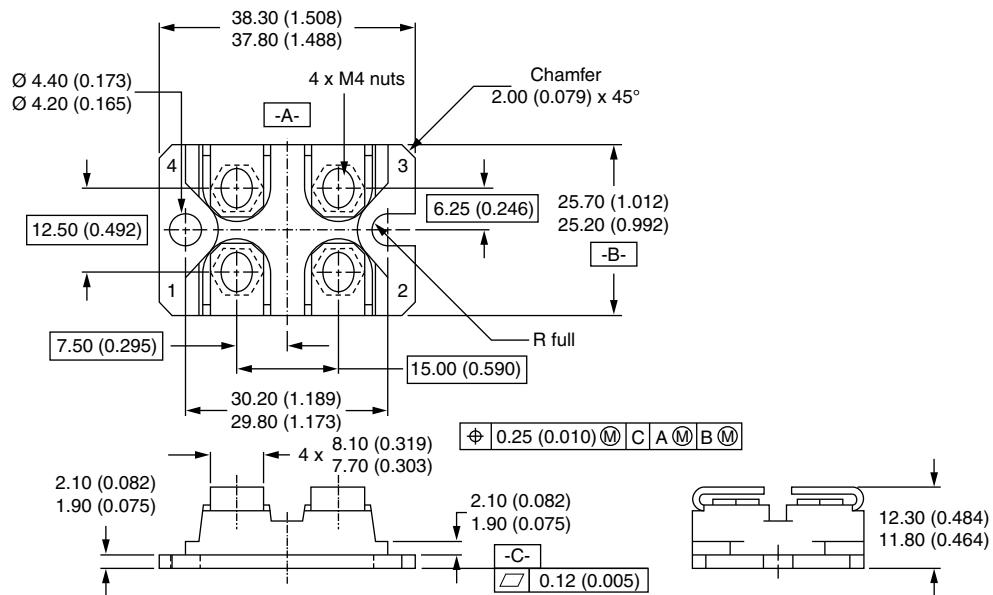
1	- Vishay Semiconductors product
2	- Power MOSFET
3	- Generation 3, MOSFET silicon, DBC construction
4	- Current rating (38 = 38 A)
5	- Single switch (see Circuit Configuration table)
6	- SOT-227
7	- Voltage rating (50 = 500 V)
8	- Low charge
9	- P = Lead (Pb)-free

CIRCUIT CONFIGURATION		
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Single switch no diode	S	 

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95036">www.vishay.com/doc?95036</a>
Packaging information	<a href="http://www.vishay.com/doc?95037">www.vishay.com/doc?95037</a>

**SOT-227**

**DIMENSIONS** in millimeters (inches)



## Notes

- Dimensioning and tolerancing per ANSI Y14.5M-1982
- Controlling dimension: millimeter

## Disclaimer

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